

### **Amendments to the Claims:**

This listing of claims will replace all prior versions, and listings, of claims in the application:

### **Listing of Claims:**

1. (Currently Amended) A semiconductor device comprising:
  - a first semiconductor layer that is formed from a first semiconductor material;
  - a second semiconductor layer that is formed from a second semiconductor material on the first semiconductor layer;
  - a two-dimensional carrier that is formed within the first semiconductor layer and in the vicinity of an interface between the first semiconductor layer and the second semiconductor layer;
  - a first concave portion that is formed penetrating at least the second semiconductor layer from a primary surface, which is a top surface, of the second semiconductor layer, and is formed from the interface to a predetermined depth in the first semiconductor layer;
  - a first electrode that is formed on a bottom surface and side surface of the first concave portion and that forms a Schottky junction to the semiconductor layers which contact the bottom surface and the side surface of the first concave portion; and
  - a second electrode that is formed in an area of the second semiconductor layer that is located away from the first electrode and that forms a low resistance contact with the second semiconductor layer,
- wherein:
  - the primary surface of the second semiconductor layer faces the interface between the first semiconductor layer and the second semiconductor layer;
  - the first semiconductor material and the second semiconductor material generate a piezoelectric polarization by distortion that is generated by the difference in the lattice constant between the first semiconductor layer and the second semiconductor layer; and

the side surface of the first concave portion is inclined against the interface so that the inclination changes the thickness of the second semiconductor layer.

2. (Currently Amended) A semiconductor device comprising:

a first semiconductor layer that is formed from a first semiconductor material;

a second semiconductor layer that is formed from a second semiconductor material on the first semiconductor layer;

a two-dimensional carrier that is formed within the first semiconductor layer and in the vicinity of an interface between the first semiconductor layer and the second semiconductor layer,

a first concave portion that is formed from a primary surface, which is a top surface, of the second semiconductor layer reaching at least the interface, and is formed to a distance that allows a quantum mechanical tunnel effect with the two dimensional carrier to be obtained;

a first electrode that is formed on a bottom surface and a side surface of the first concave portion and also formed on the primary surface of the second semiconductor layer surrounding the first concave portion, and that forms a Schottky junction to the semiconductor layers which contact therewith; and

a second electrode that is formed in an area of the second semiconductor layer that is located away from the first electrode and that forms a low resistance contact with the second semiconductor layer,

wherein:

the primary surface of the second semiconductor layer faces the interface between the first semiconductor layer and the second semiconductor layer;

the first semiconductor material and the second semiconductor material generate a piezoelectric polarization by distortion that is generated by the difference in the lattice constant between the first semiconductor layer and the second semiconductor layer; and

the side surface of the first concave portion is inclined against the interface so that the inclination changes the thickness of the second semiconductor layer.

3. (Currently Amended) A semiconductor device comprising:

- a first semiconductor layer that is formed from a first semiconductor material;
- a second semiconductor layer that is formed from a second semiconductor material above the first semiconductor layer;
- a third semiconductor layer that is sandwiched between the first semiconductor layer and the second semiconductor layer and that is formed having a thickness that allows a quantum mechanical tunnel effect to be obtained;
- a two-dimensional carrier that is formed within the first semiconductor layer and on the third semiconductor layer side of the first semiconductor layer;
- a first concave portion that is formed penetrating at least the second semiconductor layer from a primary surface, which is a top surface, of the second semiconductor layer, and is formed from a first interface between the third semiconductor layer and the second semiconductor layer to a predetermined depth in the first semiconductor layer;
- a first electrode that is formed on a bottom surface and side surface of the first concave portion and that forms a Schottky junction with the semiconductor layers which contact the bottom surface and the side surface of the first concave portion; and
- a second electrode that is formed in an area of the second semiconductor layer that is located away from the first electrode and that forms a low resistance contact with the second semiconductor layer;

wherein:

~~the primary surface of the second semiconductor layer faces the first interface between the first semiconductor layer and the second semiconductor layer;~~

the first semiconductor material and the second semiconductor material generate a piezoelectric polarization by distortion that is generated by the difference in the lattice constant between the first semiconductor layer and the second semiconductor layer; and

the side surface of the first concave portion is inclined against a second interface between the first semiconductor layer and the third semiconductor layer, and is inclined against the second interface between the third semiconductor layer and the second semiconductor layer.

4. (Previously Presented) The semiconductor device according to any one of claims 1 to 3, wherein there is further provided a second concave portion that is formed from the primary surface of the second semiconductor layer penetrating at least the second semiconductor layer, and is formed from the interface to a predetermined depth in the first semiconductor layer, and wherein

the second electrode is formed on a bottom surface and side surface of the second concave portion, and forms a low resistance contact with the semiconductor layers which contact the bottom surface and side surface of the second concave portion.

5. (Canceled)

6. (Previously Presented) The semiconductor device according to any one of claims 1 to 3, wherein the second electrode is formed from the primary surface of the second semiconductor layer to the two-dimensional carrier.

7. (Canceled)

8. (Previously Presented) The semiconductor device according to any one of claims 1 to 3, wherein, when viewed from a perpendicular direction relative to the primary surface, the second electrode surrounds the first electrode, and the inner surface of the second electrode is formed so as to face the outer surface of the first electrode.

9. (Previously Presented) The semiconductor device according to any one of claims 1 to 3, wherein, when viewed from a perpendicular direction relative to the primary surface, the second electrode is formed so as to surround the first electrode.

10. (Original) The semiconductor device according to claim 1 or claim 3, wherein the first electrode is also formed on the primary surface of the second semiconductor layer that surrounds the first concave portion.

11. (Previously Presented) The semiconductor device according to any one of claims 1 to 3, wherein a forward current passes from the first electrode to the second electrode when a voltage is applied from the first electrode to the second electrode, and a reverse current passing from the second electrode to the first electrode is restricted when the voltage is applied from the first electrode to the second electrode.

12. (Previously Presented) The semiconductor device according to any one of claims 1 to 3, wherein an inclination angle of the side surface of the first concave portion is equal to or greater than 10 degrees, and smaller than 90 degrees.